WESTON®

MODEL

1295/1296

DIGITAL PANEL METER

INSTRUCTIONS • PARTS LIST

INSTRUCTIONS/PARTS LIST

FOR

MODEL 1295/1296

DIGITAL PANEL METER

U.S. Patent 3,051,939
and Patents Pending

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WESTON INSTRUMENTS, INC.
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WESTON
Schlumberger

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TABLE 1.

TABLE OF SPECIFICATIONS

*PART NUMBER (MODEL 1295)	*PART NUMBER (MODEL 1296)	RANGE (DC)	SENSITIVITY	INPUT IMPEDANCE	#FULL SCALE PRESENTATION	MAXIMUM VOLTAGE OVERLOAD
273565	273605	1000V	1.0V	5MΩ	1000	1100V
273564	273604	100V	0.1V	5MΩ	100.0	1000V
273563	273603	10V	0.01V	5MΩ	10.00	1000V
273562	273602	1V	0.001V	100MΩ	1.000	60V
273561	273601	100mV	0.1mV	100MΩ	100.0	60V
273560	273600	100mA	0.1mA	1Ω	100.0	—
273559	273599	10mA	0.01mA	10Ω	10.00	—
273558	273598	1mA	0.001mA	100Ω	1.000	—
273557	273597	100μA	0.1μA	1KΩ	100.0	—
273556	273596	10μA	0.01μA	10KΩ	10.00	—

With 100% overrange on all ranges except 1000V range.

Max. overrange presentation 1999 on all ranges except 1000V range.

Max. voltage between common input terminal pin A and earth ground or shield pin 10 (500V rms AC/DC except on the 1000V range.)

* 117 volts and LED display.

INSTALLATION

Panel Mounting

1. Unpack the meter and perform a visual inspection to assure that no damage has occurred during shipment or handling.

2. Remove front assembly. Rotate the four mounting screws (located in the four inner corners) 3 or 4 times counterclockwise to position the mounting cams correctly. Mount the main assembly (see Figure 2) on a panel 1/16 to 1/8 inch thick. The panel shall be prepared in accordance with the panel cut-out dimensions as shown in Figure 3. Rotate the four mounting screws clockwise to position the mounting cams in the lock position and secure the instrument to the panel.

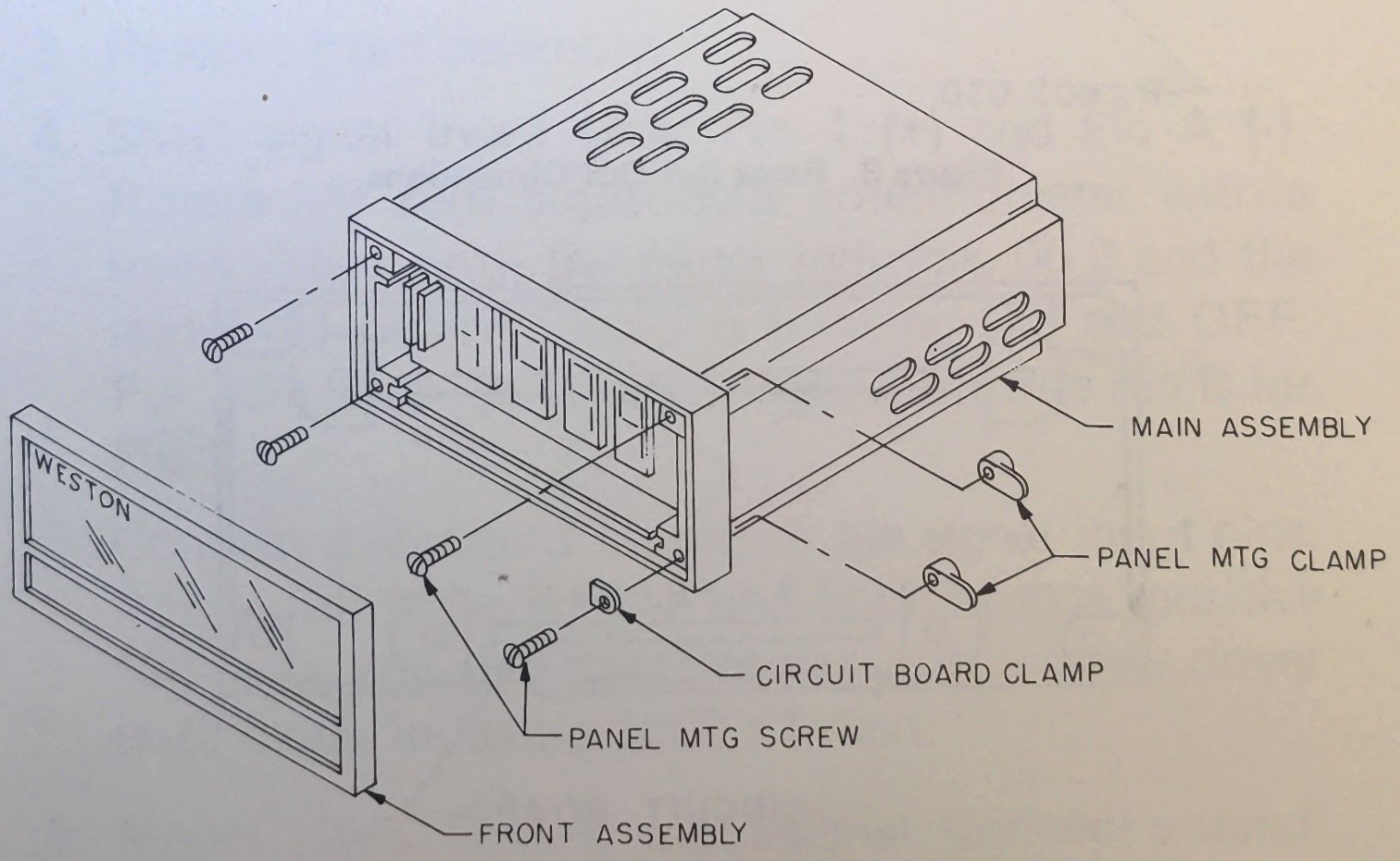


Figure 2. Meter Mounting Drawing

3. Check the displays to assure that they are securely mounted to their sockets. Press loose displays down gently to obtain a secure mounting. Do not allow oil or grease to smudge the face of the display and thereby degrade frosted finish.
4. The front assembly can be secured into position at this time. This front assembly will have to be removed to adjust and calibrate the meter.

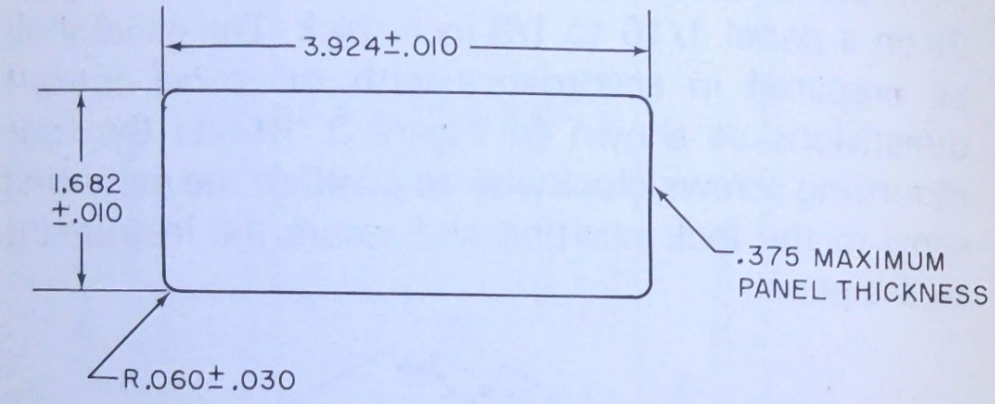


Figure 3. Panel Cut-Out Dimensions

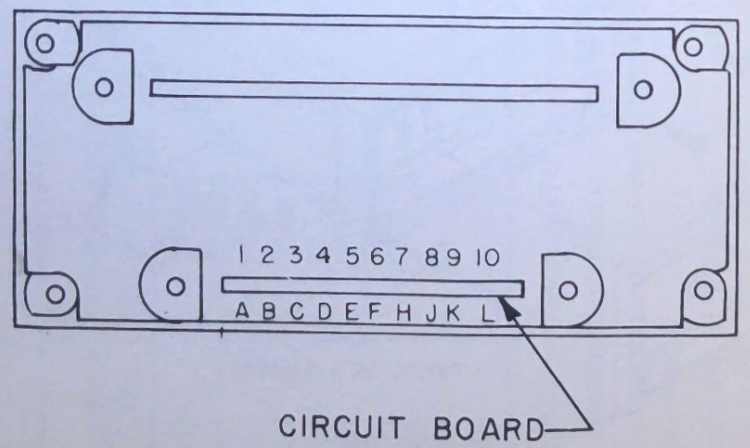


Figure 4. Rear View of Pin Designations

ADJUSTMENT AND OPERATION

Operation

The Digital Panel Meter has provisions to accept a connector at the rear of the case. A connector package is supplied as an accessory under Part Number 267432. It consists of connector, ELCO No. 00-6007-020-980-002 and two screws no. 4-40 thd x 1/2 inch long binding head.

1. After the meter has been panel mounted, connect a 117 volt single phase 50/60) or 400Hz power line as follows:
   a. One side of AC line to Pin K
   b. One side of AC line to Pin L
   c. Earth ground to Pin 10
2. Allow meter to warm up for a period of 15 minutes.
3. Remove front assembly.
4. Short signal input pins; Pin 1 (+) and Pin A (-). Rotate left zero adjustment potentiometer with a screw driver until the meter indicates 00.0 and the minus (-) polarity lamp is blinking ON and OFF. For 10V through 1000V ranges substitute Pin B for Pin 1.
5. Connect a standard source to the signal input pins. Apply full scale voltage and rotate center positive full scale adjust potentiometer with a screw driver until meter indicates 1000 ±1 digit.
6. Model 1295 - Reverse input signal. Connect a standard source to the signal input pins. With full scale

voltage applied rotate RIGHT negative full scale adjust potentiometer with a screw driver until meter indicates -1000 ±1 digit.

Model 1296 - No adjustment is provided for a negative signal.

7. Repeat steps 4, 5 and 6 as necessary until proper adjustment is achieved. The instrument is now ready for operation.
8. Full scale digital presentation is tabulated in Table 1. However, the meter is capable of being operated beyond this range plus 100% or minus 100%. For example, the operational range of 1 Volt DC meter is +1.999 volts to -1.999 volts.

   Model 1296 - The negative range has a ±10% accuracy tolerance.
9. An overrange situation exists when more than 1.999 volts is applied on a 1 volt range. If the applied input voltage is greater than ±200% of range only the leading one digit will illuminate and blink.
10. Selection of the decimal point is accomplished by shorting a solder bridge on the display board. The bridges are numbered 1 through 3 referred to the most significant digit which the decimal point follows.
11. The following table depicts basic conditions which may exist during the course of normal meter operation. The example given is for a one volt range meter.

APPLIED SIGNAL VOLTAGE	INDICATION ON DISPLAY
+2.000 & higher	1.XXX (Blinking)
+.000 to 1.999	.000 to 1.999
–.000 to 1.999	–.000 to 1.999
–2.000 & higher	–1.XXX (Blinking)

Range and Readout Slope Changes

Range changing is easily accomplished in the instrument. Table 2 shows the component values for any of 10 ranges and Figure 5 shows the location of components on the circuit board.

Slope (input vs readout) adjustments are made in a similar manner. If a readout is desired in engineering units, i.e., feet, pounds, RPM, etc., which do not directly relate to the input, data can be provided instructing how to determine values of range resistors for particular applications.

TABLE 2.

RANGE CHANGING

RANGE	SOLDER BRIDGE K	R129 PAD C-D	R127 PAD A-B	R128 PAD B-C
10μA	Bridge	10KΩ	–	–
100μA	Bridge	1KΩ	–	–
1mA	Bridge	100Ω	–	–
10mA	Bridge	10Ω	–	–
100mA	Bridge	1Ω	–	–
100mV	Bridge	–	–	–
1V	Open	–	–	–
10V	Bridge	49.9KΩ	2.49MΩ	2.49MΩ
100V	Bridge	4.9KΩ	2.49MΩ	2.49MΩ
1000V	Bridge	499Ω	2.49MΩ	2.49MΩ

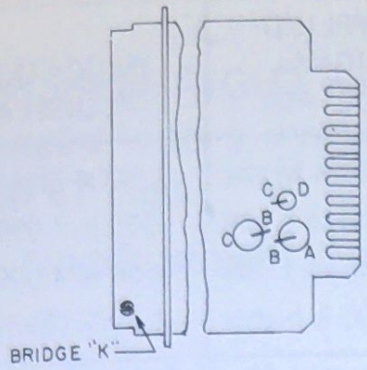
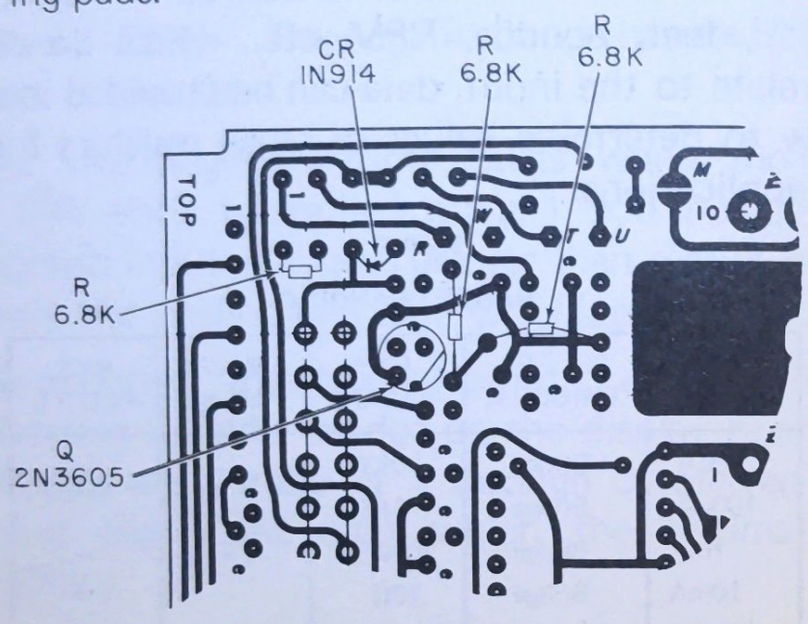


Figure 5. Location of Range Change Components on Circuit Board

Illumination of "+" Indicator

If it is desired to illuminate the + indicator in the instrument, electrical components can be soldered to the main circuit board for this optional feature. Figure 6 shows the location for connecting components to the soldering pads.



Description	Part No.
Resistor, 6.8K ±5%, 1/4 watt (3 reqd)	269891-001
Transistor, 2N3605	268796-001
Diode, 1N914	ND61025-001

Figure 6. Location of Components on Circuit Board for Illumination of "+" Indicator

THEORY OF OPERATION

General

This section in conjunction with the block diagram Figure 7 and waveforms Figure 8, contains a discussion of the theory of operation of the Digital Panel Meter.

Basically, the instrument is a single range, high input impedance, bi-polar digital panel meter that is capable of being constructed as a voltmeter or current meter with the addition of an appropriate attenuator or shunt. Standard self-contained current or voltage ranges are available from Weston as shown in Table 1.

The instrument utilizes a dual slope integrating technique designed with sampling intervals related to the power line frequency. Dual slope is a method of A/D conversion which grants immunity to random and power frequency noise accompanying the input signal and to power supply ripple. Integrating time is typically 250 milliseconds, providing rejection of 60Hz and 400Hz whose periods are sub-multiples of 250 milliseconds.

Dual slope converts the input signal into a ratio of two time intervals, both proportional to clock period, making the accuracy of conversion independent of clock accuracy. The accuracy of conversion is dependent upon the stability of the internal reference circuits.

Waveforms are shown in Figure 8. The integrating time T is constant at 250 milliseconds, corresponding to 10,000 pulses from the 40KHz clock oscillator.

The cycle is divided into two intervals; ramp up t_1, and ramp down t_2. During t_1, the integrator charges to a voltage $\frac{e_{in}\ t_1}{RC}$

During t_2, the capacitor discharges an equal amount under the influence of e_{in} and I_{Ref} such that:

$$\frac{e_{in}\ t_1}{RC} = \left(I_{Ref} - \frac{e_{in}}{R}\right) \frac{t_2}{C}$$

and since $t_1 + t_2 = T$

$$t_2 = \frac{e_{in}\ T}{I_{Ref}\ R}$$

Now the interval T is determined by 10,000 clock pulses and thus lasts $10{,}000/f_{clock}$ seconds. The number of clock pulses N in t_2 is $t_2 \times f_{clock}$. Thus

$$N = \frac{e_{in}\ 10{,}000}{I_{Ref}\ R}$$

a quantity independent of f_{clock}. Since the interval t_2 starts at a count of 10,000 (or zero) the count at the end of t_2 is equal to N. A storage command at that time transfers the count into display storage.

The conversion process is cyclic with a conversion every 250 milliseconds. If the new count is the same as the previous one, the number in storage will not change, and no display change results. The key events in each cycle are the count 10,000 which initiates t_2 by introducing a reference current and the crossing of zero by the integrator which terminates t_2 and commands a readout into storage. The polarity of the reference current can be negative or positive depending on the polarity of e_{in}.

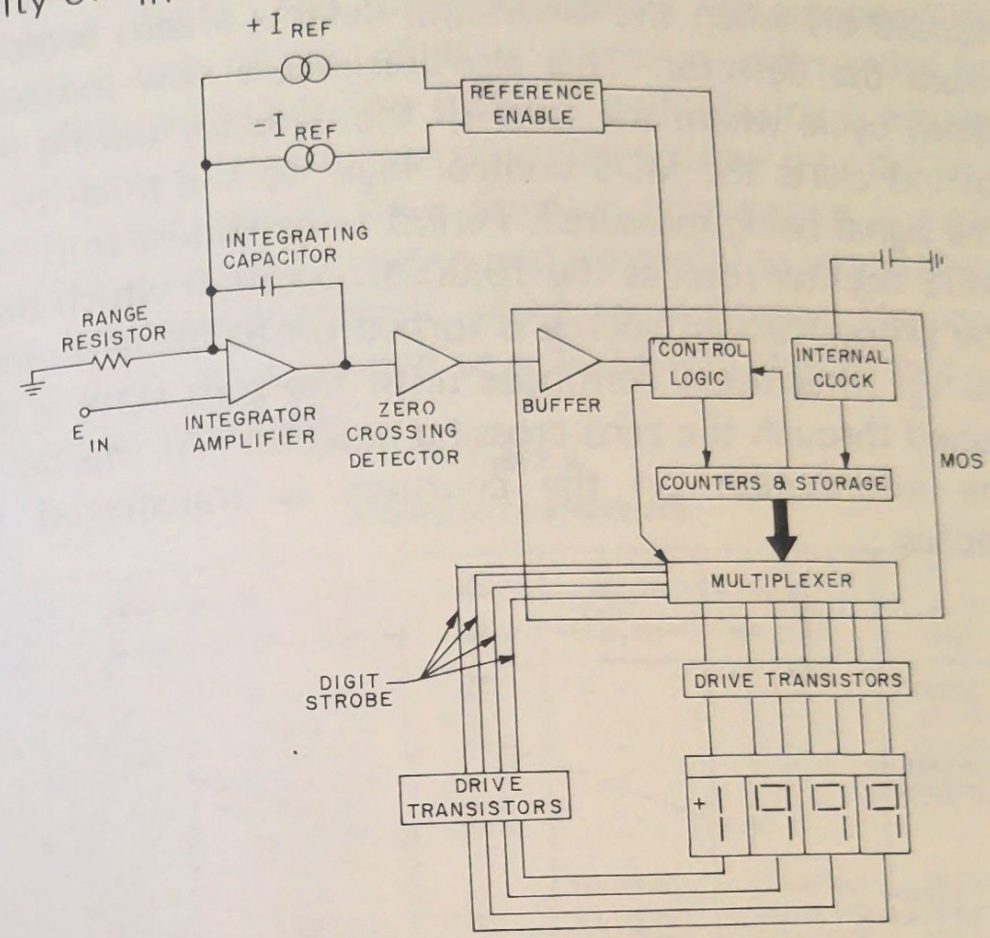


Figure 7. Block Diagram

MOS Operation (See Figure 7)

The MOS package controls the injection of current references into the integrator-amplifier and has as its only input a zero crossing detector. The output from the MOS package is used to drive a seven segment numeric display.

The overall operation is controlled by two internal flip-flops: one whose states correspond to either interval

t_1 or t_2, and a second whose states correspond to either a positive or negative input. The current sources are turned off when the MOS chip detects a zero crossing from the detector. This also initiates a new measurement cycle where the level of the detector during this period alerts the MOS control logic to the polarity of the signal being measured. Period t_1 continues until the MOS counter reaches the 10,000th count at which time the proper current source is turned on to initiate interval t_2. Integration continues until the zero state is detected through the zero crossing detector. At this point the information on the counters is transferred to latches.

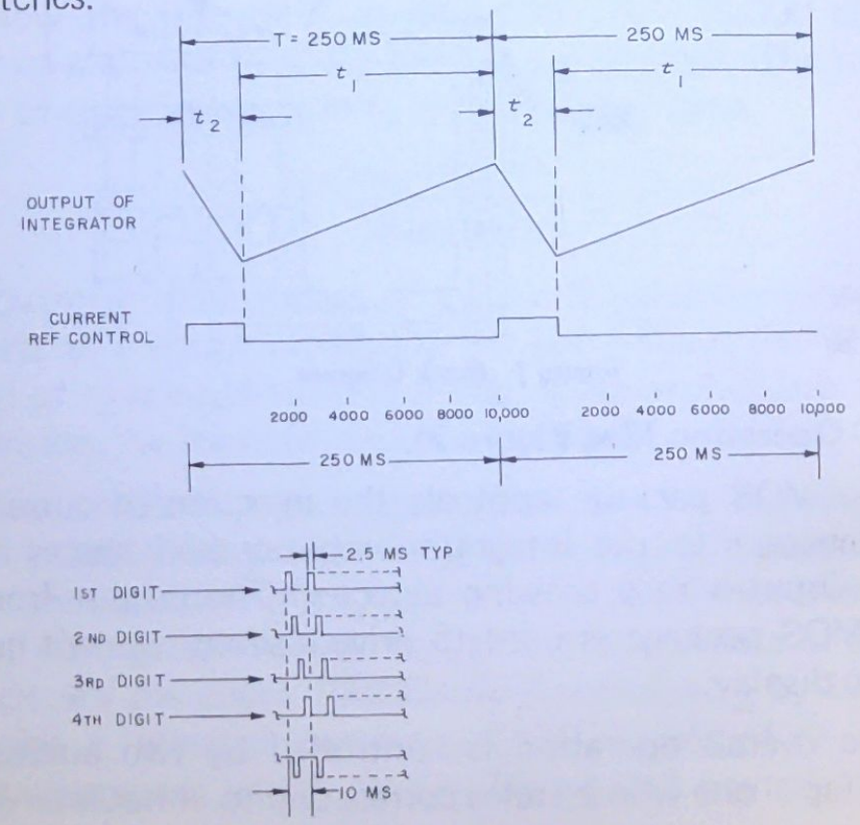


Figure 8. Waveforms

The display is effected by providing a time-multiplexed seven segment code on the same seven lines for all four digits. The individual digits are separated by enabling one display digit at a time as commanded by the MOS package. The internal multiplexing is accomplished by driving a four state ring counter by a divided-down clock signal. This counter information is made available externally and is used internally to sequentially gate the individual digits, which are in storage. The complete scan is performed at a 100 Hertz rate so that no flicker is observable.

TABLE 3.

RANGING COMPONENTS

MODEL 1295 BOARD ASSY PART NUMBER	MODEL 1296 BOARD ASSY PART NUMBER	RANGE	R127 PAD A-B	R128 PAD B-C	R129 PAD C-D
273395-901	273396-901	10μA	–	–	266627-001
273395-902	273396-902	100μA	–	–	266628-001
273395-903	273396-903	1mA	–	–	264775-001
273395-904	273396-904	10mA	–	–	264773-001
273395-905	273396-905	100mA	–	–	264776-001
273395-906	273396-906	100mV	–	–	–
273395-907	273396-907	1V	–	–	–
273395-908	273396-908	10V	270197-001	270197-001	269884-001
273395-909	273396-909	100V	270197-001	270197-001	269911-001
273395-910	273396-910	1000V	270197-001	270197-001	270194-001

TABLE 4.

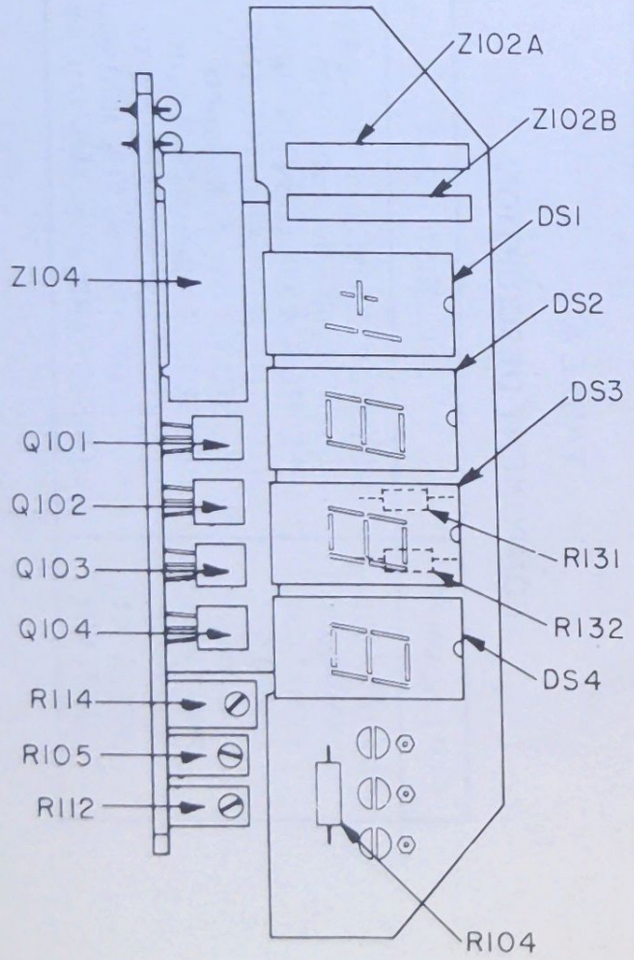
COMPONENT DESCRIPTION

PART NUMBER	DESCRIPTION
270197-001	RESISTOR, 2.49M ohms ±1%, 3/4 watt
270194-001	RESISTOR, 499 ohms ±1%, 1/10 watt
269911-001	RESISTOR, 4.99K ohms ±1%, 1/8 watt
269884-001	RESISTOR, 49.9K ohms ±1%, 1/10 watt
264776-001	RESISTOR, 1 ohm ±1%, 2 watts
264773-001	RESISTOR, 10 ohms ±1%, 2 watts
264775-001	RESISTOR, 100 ohms ±1%, 2 watts
266628-001	RESISTOR, 1K ohms ±1%, 1/10 watt
266627-001	RESISTOR, 10K ohms ±1%, 1/10 watt

NOTE: Board assembly illustrated is for the Model 1295.

Part variations between Model 1295 and Model 1296 are noted in the Description column of the Parts List.

(1) CR111 and CR112 on circuit boards in early models. Q124 in later models. Parts not interchangeable.



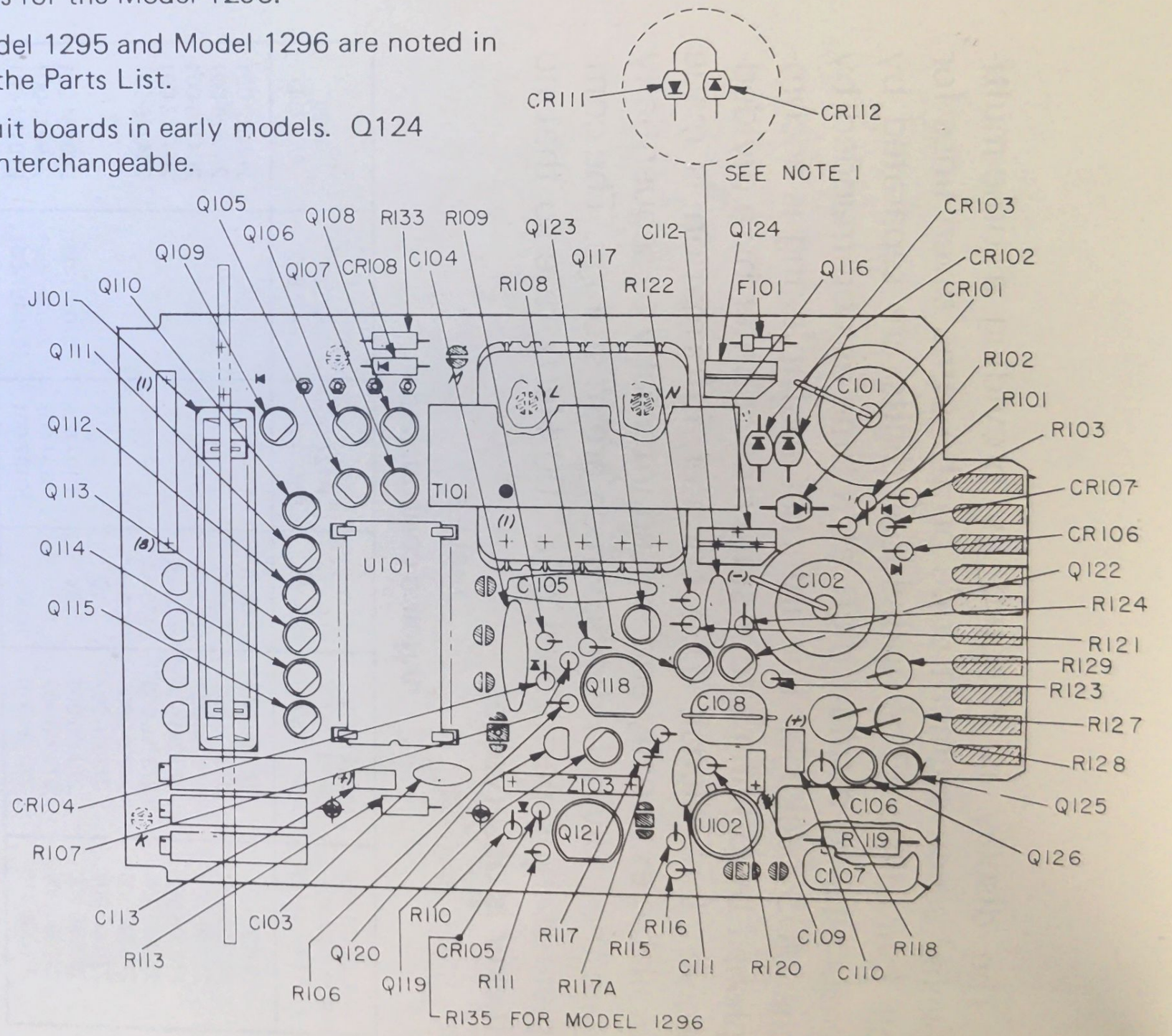
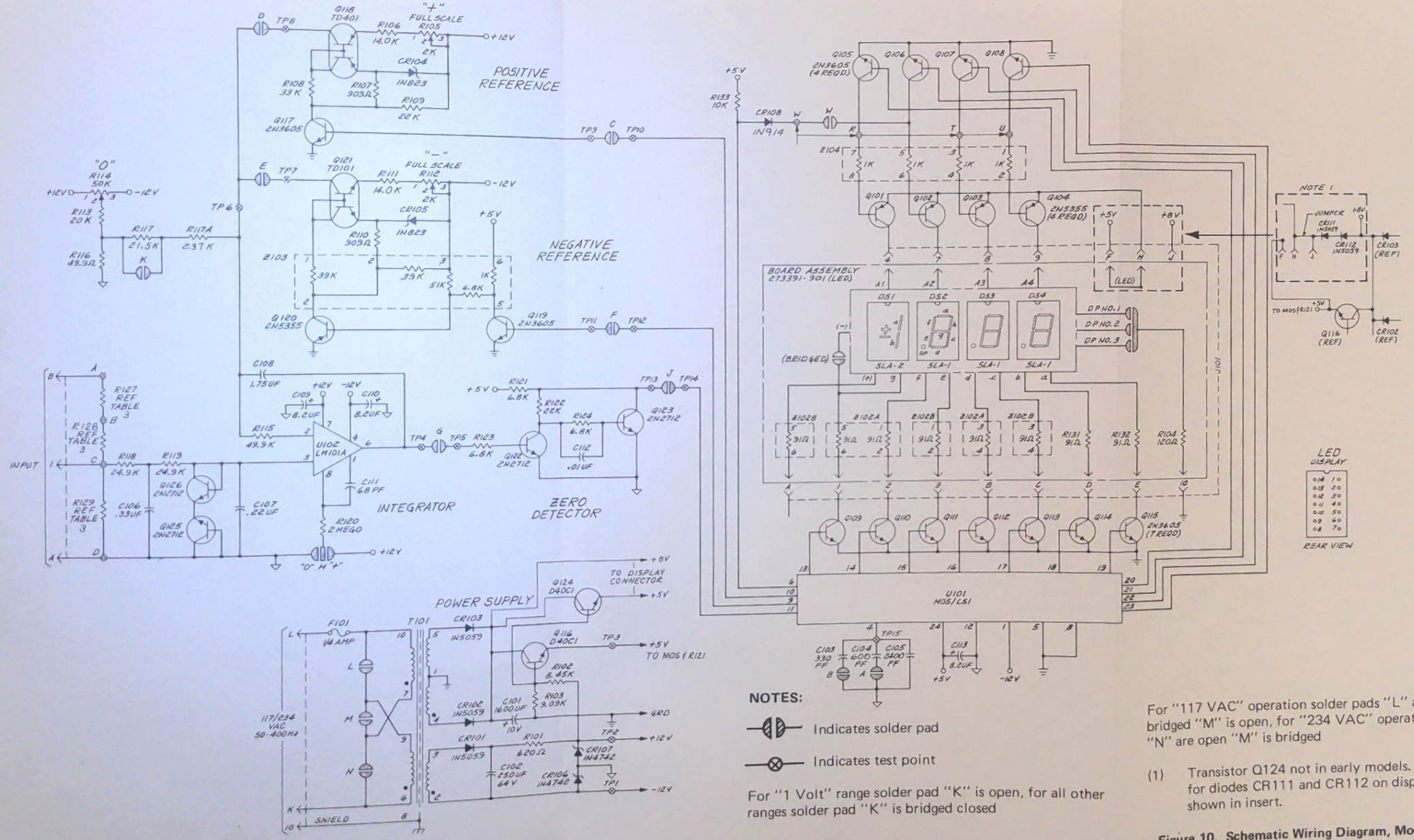


Figure 9. Board Assembly



NOTES:

Indicates solder pad

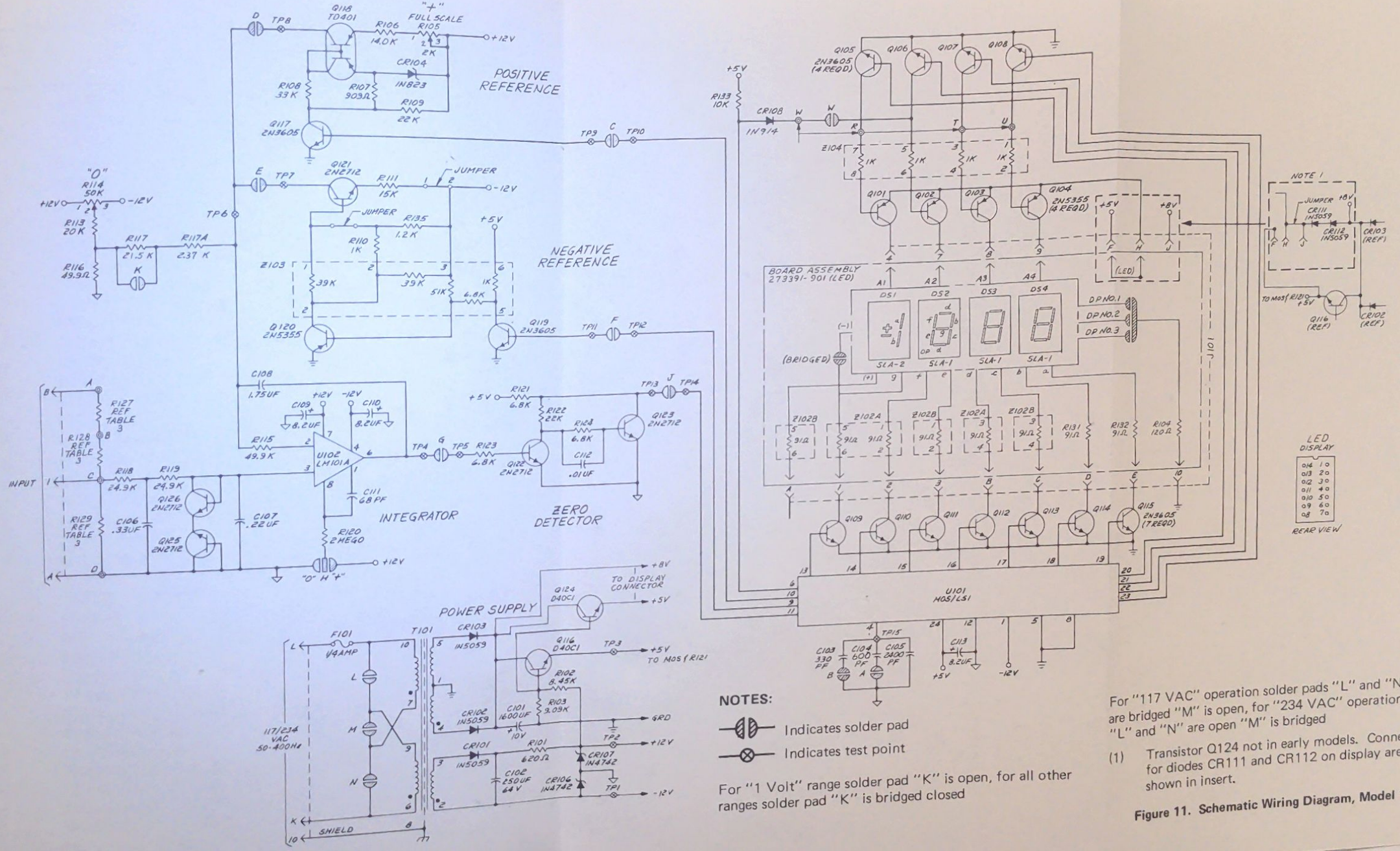
Indicates test point

For "1 Volt" range solder pad "K" is open, for all other ranges solder pad "K" is bridged closed

For "117 VAC" operation solder pads "L" and "N" are bridged "M" is open, for "234 VAC" operation "L" and "N" are open "M" is bridged

(1) Transistor Q124 not in early models. Connections for diodes CR111 and CR112 on display are as shown in insert.

Figure 10. Schematic Wiring Diagram, Model 1295



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(1) Transistor Q124 not in early models. Connections for diodes CR111 and CR112 on display are as shown in insert.

Figure 11. Schematic Wiring Diagram, Model 1296

PARTS LIST

REFERENCE SYMBOL	DESCRIPTION	PART NUMBER
C101	CAPACITOR, 1600μF, +50% -10%, 10WVDC	266607-001
C102	CAPACITOR, 250μF, 64WVDC	266349-001
C103	CAPACITOR, 330pF, ±10%, 1000WVDC	270044-001
C104	CAPACITOR, 600pF, ±10%, 500WVDC	274133-001
C105	CAPACITOR, 2400pF, ±10%, 500WVDC	274156-001
C106	CAPACITOR, 0.33μF, 250WVDC	272281-001
C107	CAPACITOR, 0.22μF, ±20%, 250WVDC	272263-001
C108	CAPACITOR, 1.75μF, ±10%, 100WVDC	269897-001
C109	CAPACITOR, 8.2μF, ±20%, 15WVDC	269952-001
C110	CAPACITOR, 8.2μF, ±20%, 15WVDC	269952-001
C111	CAPACITOR, 68pF, ±10%, 1000WVDC	272422-001
C112	CAPACITOR, 0.01μF, +80% -20%, 50WVDC	269899-001
C113	CAPACITOR, 8.2μF, ±20%, 15WVDC	269952-001
CR101	DIODE, 1N5059	266611-001
CR102	DIODE, 1N5059	266611-001
CR103	DIODE, 1N5059	266611-001
CR104	DIODE, 1N823	ND60978-001
CR105	DIODE, 1N823 (Model 1295) NOT USED (Model 1296)	ND60978-001 264601-001
CR106	DIODE, 1N4742	264601-001
CR107	DIODE, 1N4742	ND61025-001
CR108	DIODE, 1N914	266611-001
CR111	DIODE, 1N5059	266611-001
CR112	DIODE, 1N5059	274171-001
DS1	DISPLAY, NUMERIC, SLA-2	271955-001
DS2	DISPLAY, NUMERIC, SLA-1	271955-001
DS3	DISPLAY, NUMERIC, SLA-1	271955-001
DS4	DISPLAY, NUMERIC, SLA-1	272753-001
F101	FUSE, 1/2 AMP	272779-001
J101	CONNECTOR	272893-001
Q101	TRANSISTOR, 2N5355	272893-001
Q102	TRANSISTOR, 2N5355	272893-001
Q103	TRANSISTOR, 2N5355	272893-001
Q104	TRANSISTOR, 2N5355	268796-001
Q105	TRANSISTOR, 2N3605	268796-001
Q106	TRANSISTOR, 2N3605	268796-001
Q107	TRANSISTOR, 2N3605	268796-001
Q108	TRANSISTOR, 2N3605	268796-001
Q109	TRANSISTOR, 2N3605	

REFERENCE SYMBOL	DESCRIPTION	PART NUMBER
Q110	TRANSISTOR, 2N3605	268796-001
Q111	TRANSISTOR, 2N3605	268796-001
Q112	TRANSISTOR, 2N3605	268796-001
Q113	TRANSISTOR, 2N3605	268796-001
Q114	TRANSISTOR, 2N3605	268796-001
Q115	TRANSISTOR, 2N3605	268796-001
Q116	TRANSISTOR, D40C1	268797-001
Q117	TRANSISTOR, 2N3605	268796-001
Q118	TRANSISTOR, TD401	269904-001
Q119	TRANSISTOR, 2N3605	268796-001
Q120	TRANSISTOR, 2N5355	272893-001
Q121	TRANSISTOR, TD101 (Model 1295)	266399-001
Q121	TRANSISTOR, 2N2712 (Model 1296)	ND39917-001
Q122	TRANSISTOR, 2N2712	ND39917-001
Q123	TRANSISTOR, 2N2712	ND39917-001
Q124	TRANSISTOR, D40C1	268797-001
Q125	TRANSISTOR, 2N2712	ND39917-001
Q126	TRANSISTOR, 2N2712	ND39917-001
R101	RESISTOR, 620 ohms ±5%, 1/4 watt	274167-001
R102	RESISTOR, 8.45K ohms ±1%, 1/10 watt	272482-001
R103	RESISTOR, 9.09K ohms ±1%, 1/10 watt	269883-001
R104	RESISTOR, 120 ohms ±5%, 1/4 watt	272718-001
R105	POTENTIOMETER, 2K ohms	266306-001
R106	RESISTOR, 14K ohms ±1%, 1/10 watt	269882-001
R107	RESISTOR, 909 ohms ±1%, 1/10 watt	269916-001
R108	RESISTOR, 33K ohms ±5%, 1/4 watt	269869-001
R109	RESISTOR, 22K ohms ±5%, 1/4 watt	264674-001
R110	RESISTOR, 909 ohms ±1%, 1/10 watt (Model 1295)	269916-001
R110	RESISTOR, 1000 ohms ±5%, 1/4 watt (Model 1296)	266612-001
R111	RESISTOR, 14K ohms ±1%, 1/10 watt (Model 1295)	269882-001
R111	RESISTOR, 15K ohms ±5%, 1/4 watt (Model 1296)	263655-001
R112	POTENTIOMETER, 2K ohms (Model 1295)	266306-001
R112	NOT USED (Model 1296)	–
R113	RESISTOR, 20K ohms ±1%, 1/10 watt	269881-001
R114	POTENTIOMETER, 50K ohms	270055-001

REFERENCE SYMBOL	DESCRIPTION	PART NUMBER
R115	RESISTOR, 49.9K ohms ±1%, 1/10 watt	264689-001
R116	RESISTOR, 49.9 ohms ±1%, 1/10 watt	269886-001
R117	RESISTOR, 21.5K ohms ±1%, 1/10 watt	264691-001
R117A	RESISTOR, 2.37K ohms ±1%, 1/10 watt	266630-001
R118	RESISTOR, 24.9K ohms ±1%, 1/10 watt	272868-001
R119	RESISTOR, 24.9K ohms ±1%, 1/10 watt	272868-001
R120	RESISTOR, 2M ohms ±5%, 1/4 watt	269932-001
R121	RESISTOR, 6.8K ohms ±5%, 1/4 watt	269891-001
R122	RESISTOR, 22K ohms ±5%, 1/4 watt	264674-001
R123	RESISTOR, 6.8K ohms ±5%, 1/4 watt	269691-001
R124	RESISTOR, 6.8K ohms ±5%, 1/4 watt	269691-001
R127	RESISTOR, Selected - Ref. Tables 3 and 4	–
R128	RESISTOR, Selected - Ref. Tables 3 and 4	–
R129	RESISTOR, Selected - Ref. Tables 3 and 4	–
R131	RESISTOR, 91 ohms ±5%, 1/4 watt	274100-001
R132	RESISTOR, 91 ohms ±5%, 1/4 watt	274100-001
R133	RESISTOR, 10K ohms ±5%, 1/4 watt	264673-001
R135	NOT USED (Model 1295)	–
R135	RESISTOR, 1.2K ohms ±5%, 1/4 watt (Model 1296)	266614-001
T101	TRANSFORMER	273393-901
U101	MICROCIRCUIT, MOS/LSI	272612-001
U102	MICROCIRCUIT, LM101A	271852-001
Z102A	RESISTOR MODULE	273392-001
Z102B	RESISTOR MODULE	273392-001
Z103	RESISTOR MODULE	272159-001
Z104	RESISTOR MODULE	273375-001
–	BOARD, CIRCUIT, MAIN	273394-901
–	BOARD, CIRCUIT, DISPLAY	273390-901
–	FRONT	265657-901
–	CASE (Model 1295)	273757-901
–	CASE (Model 1296)	273758-901
–	WINDOW, MICROAMPERE RANGES	273756-903
–	WINDOW, MILLIAMPERE RANGES	273756-904
–	WINDOW, MILLIVOLT RANGE	273756-901
–	WINDOW, VOLT RANGES	273756-902
–	CLAMP, PANEL MTG (4 reqd)	265661-024
–	CLAMP, CIRCUIT BOARD	265663-001
–	SCREW, CLAMP (4 reqd)	266623-045

WESTON EQUIPMENT WARRANTY

Weston warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Weston equipment, at an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that (a) Seller is promptly notified in writing by Buyer upon discovery of defects, (b) Upon receipt of written authorization from Seller the defective equipment is returned as directed, transportation charges prepaid by Buyer, and, (c) Seller's examination of such equipment discloses to his satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer. Any modification such as changing range resistors may void this warranty.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited life electrical components which deteriorate with age such as tubes, lamps, etc.

This warranty is in lieu of all other warranties, expressed or implied, including the implied warranty of fitness for a particular purpose to the original purchaser or to any other person. Seller shall not be liable for consequential damages of any kind.

The aforementioned provisions do not extend the original warranty period of any article which has been either repaired or replaced by Seller.